SUMMARY OF THE INVENTION

Instead of constructing a full multi-dimensional look up table as a model to find the critical dimension or other parameters in scatterometry, regression or other optimized estimation methods are employed starting from a "best guess" value of the parameter. Eigenvalues of models that are precalculated may be stored and reused later for other structures having certain common characteristics to save time. The scatterometric data that is used to find the value of the one or more parameter can be limited to those at wavelengths that are less sensitive to the underlying film characteristics. A model for a three-dimensional grating may be constructed by slicing a representative structure into a stack of slabs and creating an array of rectangular blocks to approximate each slab. One dimensional boundary problems may be solved for each block which are then matched to find a two-dimensional solution for the slab. A three-dimensional solution can then be constructed from the two-dimensional solutions for the slabs to yield the diffraction efficiencies of the three-dimensional grating. This model can then be used for finding the one or more parameters of the diffracting structure in scatterometry. Line roughness of a surface can be measured by directing a polarized incident beam in an incident plane normal to the line grating and measuring the cross-polarization coefficient. The value of the one or more parameters may then be supplied to a stepper or etcher to adjust a lithographic or etching process.